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ABSTRACT

This study examined the patterns of use, effects on roles and relationships, problems and preparations needs posed by the use of the Internet in middle school classrooms. Two technology-rich inner city middle schools in the Greater Los Angeles area were selected as pools from which to select teacher participants. Data collection was designed to gather information on teachers' preplanning processes, the actual instructional processes, and teachers' and students' reflections about instruction. Teacher responses to the following questions are provided: (1) "In what ways do teachers use online communications in the classroom?"; (2) "In what subject fields do teachers use online communications?"; (3) "What purpose(s) does the new technology serve in the curriculum?"; (4) "What problems do teachers and students encounter when using online communications?"; (5) "How does the use of the new technology affect the learning environment?"; (6) "How does the use of the new technology affect roles and relationships in the learning environment?"; (7) "What are the perceptions of teachers and students regarding impact and value of this technology?"; and (8) "What preparation is needed by teachers and students to use the new technology?" Results and implications are discussed in terms of philosophic and sociological, management, and curriculum and instructional issues. (AEF)

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MIDDLE SCHOOL TEACHERS' USE OF ON-LINE COMMUNICATIONS

by

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Middle School Teachers' Use of On-Line Communications

How do middle school teachers use the Internet in their classrooms? Does use of the Internet require substantive change in the regular curriculum? Advocates claim that the Internet has the potential to revolutionize education. Its use poses great challenges and opportunities for curriculum development and teaching methodology. Schools spend scarce resources to acquire the technology needed to have Internet access, yet one wonders whether the investment pays off in terms of changing the nature of teaching and learning and increasing academic outcomes.

Do teachers use this new technology (like others before it) as an activity for students when they finish with the 'real assignment?' These questions, and others, guided this study to uncover the patterns of use, the effect on roles and relationships, the problems, and preparation needs posed by use of the Internet in middle school classrooms.

Early use of computers in schools supported the behavioristic model of teaching with software programs that provided drill and practice exercises for students. Such use of technology did not require major change in the curriculum because the exercises were easily added on to the traditional curriculum. In contrast, on-line technology which involves the use of computer networks to communicate with teachers and learners throughout the world, has the potential to stimulate a constructivist approach to teaching and learning, and support a more learner-centered environment. So great is the promise of this technology that one of the goals of the federal government is to have every classroom connected to the Internet by the year 2000.

Research on Use of the Internet

Some research studies on the use of the Internet in schools found that access to the Internet among students changed the dynamics of interaction by removing many of the barriers to communication that were present in face to face communication (Harasim, 1993). Others found that on-line communication among classes of students tended to open up avenues of collaboration among teachers (Riel, 1994). Becker (1992), Irving (1991), and Hadley and Sheingold (1993) found that when technology was integrated into instructional practices, teachers became coaches or facilitators who guided and monitored student learning.

Apart from these empirical studies, several articles have been written about the use of the Internet. Many of them claim that the Internet is revolutionizing classrooms, redefining education and the roles of teachers and students. The literature also documents independent efforts of teachers, schools or districts in acquiring and using the Internet. There is evidence that teachers use the Internet to share lesson plans, ideas and software, to download free resources and information, and to connect students from different cultures in order to exchange views and concerns (Wilson & Utecht, 1995).

Rhodes (1995) discussed technology-driven systemic change and noted that in order to determine the value of technology in schools, one must first define the nature of schools. He stated that the traditional role of schools has been to 'transmit or deliver ' knowledge. Therefore any technology that will change this nature of schools is often unused. Given this basic (mis)understanding of the nature of schools, it is no wonder that technology has added cost but no value to the overall work of schooling. Rhodes believes that this is the reason that technology is acquired but never used to their full potential in teaching. This underscores the point that to maximize the potential of technological innovations such as the Internet and reap their full benefit, there needs to be a paradigm shift from the traditional roles of schools, teaching practices and learning styles.

New Roles in Teaching, Learning and the Learning Environment

Cognitive science presents learning as a natural activity that is influenced, to a large extent, by the learners themselves. From birth, humans begin to seek meaning, to make sense of the world around them. Learners take in information from interactions with the surrounding environment, connect it to what they already know, and construct new knowledge and skills. Good teachers operate within the constructivist framework described above. They recognize that learning is the end result of

countless personal interactions between teacher and student. In a nationwide survey of teachers' use of technology Hadley and Sheingold (1993) report findings of teachers who state that with technology, their roles have changed from lecturing to monitoring, facilitating, and being more of a resource person.

In a report on teachers' use of Computer Assisted Instruction (CAI) to teach higher level thinking skills, Carney (1986) states that the critical factor that influences the development of cognitive skills in students is not the software but the teacher. The teacher can structure the learning environment such that the computer becomes a vehicle for students to develop creative problem solving skills. Technology can be a powerful helpmate to a teacher in creating interactive, student-centered learning environments.

Cuban (1986) found in his review of classroom use of technology since 1920 that many researchers attributed the failure of technology innovations to teachers' inability to adapt their teaching styles to maximize the potential of these innovations. Teachers who were successful at integrating technology in their teaching reported a change from the traditional teacher role of the 'dispenser' of knowledge to relatively passive learners to a 'facilitator' who guides active learners in their quest for knowledge. Oates (1985) found that teachers needed to create an intellectual environment where knowledge was acquired. Teachers were viewed as creators of an interactive learning environment or as 'managers of information' in the classroom.

In the literature that describes the kind of teacher who integrates technology in the classroom, terms such as coach, guide, organizer, facilitator, initiator, resource, diagnostician are used to describe the role of the teacher. This is not a new concept of teaching because Dewey advocated student-initiated activities as far back as 1933. The teacher is sometimes the learner and explorer along with the students not the all knowing controller of activities.

According to Salomon (1992) the design of technology supported learning environments should ensure that the learner, not the machine does the thinking and problem solving. The development of the classroom culture is important in determining if the environment supports student collaboration. Salomon suggests that in studying teaching and learning with technology, researchers should focus not only on the impacts of the technology on the individuals, but the changes in the individuals within a social context that changes as well. This means that in such a study, one cannot control all the variables.

Teachers' Resistance to Technology Use

Teachers' resistance to use of computers or other technology can be categorized into two levels. There are teachers who are resistant to the use of the technology hardware and hence do not use the technology (Reiser and Dick, 1990; Sandholtz, Ringstaff, and Dwyer, 1990; Wiske, Zodhiates, Wilson, Watt, and Williams 1990; McMahon, 1990; Cuban, 1989), and there are those who use the technology but are resistant to the new role of teaching described in the previous section. Among this latter group there are two levels of users: those that use technology as another medium to transmit knowledge (usually through drill and practice) to passive learners, and those teachers who have changed from 'transmitters' to 'facilitators.' The following discussion will focus on the literature on teachers' resistance to changes in teacher roles.

Resistance to Change of Teacher Roles:

The application of technology in the classroom varies among users. Certain activities like drill and practice exercises do not affect the traditional student-teacher roles and relationships. Such applications of technology maintain the status quo of the teacher as the controller and transmitter of knowledge. On the other hand, student-centered learning activities such as open-ended inquiry and problem solving shift the responsibility for learning to the student. It is important to note that teachers' roles do not change simply because they use computers in the classroom. The change occurs only to the extent that a shift in responsibility to the learner occurs. In other words, the teachers' roles change as much as they allow the role of students to change. The more responsibility is given to students, the greater the shift in the teacher's role.

The role of the teacher seems to be on a continuum. At one end is the traditional lecturer and imparter of knowledge, while at the other end is the teacher that creates an environment for student-directed learning. The learning theory embraced by the traditional end of the continuum is objectivist-based. This theory views knowledge as an entity and can be acquired by using the senses (Lakoff & Johnson, 1987). Teachers acquire this 'entity' and then pass it on to students. The learning theory at the other end of the continuum is constructivism. This viewpoint is that knowledge exists within each person's mind and is uniquely shaped by individual experiences (Von Glasersfeld, 1989). Therefore the teachers perception of truth or knowledge will differ from the student's perception. The constructivist teacher accepts this theory and will create learning environments that allow students to construct their own meaning.

The shift in the teacher's role may then be attributed to an underlying change in learning theory. This difference in learning theory could distinguish the users, nonusers, and teachers along the continuum. Some teachers are content with using technology only if they can still control the instruction; this is consistent with the objectivist theory. The constructivist teacher uses technology to facilitate open-ended, student-centered learning environments. They necessarily relinquish some control and consequently accept a different role in the classroom.

Luehrman (1985) predicted that the computer will not have a major impact on schools because of the required shift of teaching and learning roles, and teacher-student relationships. He also stated that teachers act independently and in isolation in making decisions regarding use of technology. An alternative view by Tobin and Dawson (1992) is that the resistance to using technology is a manifestation of the society's collective resistance. They state that teachers are more likely to adopt reforms that are consistent with the culture (school) in which they function.

The dynamic and ever-changing nature of the Internet and the world of information it can access contradicts the theory that knowledge is an entity that can be transmitted from one source to another. The nature of this study was exploratory and explanatory in the sense that it sought to investigate the use of on-line communications in classroom teaching and learning to discover the variables that affected its use; and because the investigators sought to explain the forces that shape the use of on-line communications (Yin, 1989).

Theoretical Frameworks

Two theories guided the investigation: constructivist learning theory was used to characterize student learning; and teacher decision making was adapted to characterize instructional use of the computer.

Constructivism is a theory that defines knowledge as temporary, developmental, socially and culturally mediated, and thus non-objective. Learning from this perspective is understood as a self-regulated process of resolving inner cognitive conflicts that often become apparent through concrete experience, collaborative discourse, and reflection (Brooks & Brooks, 1993). The constructivist theory developed from two distinct traditions in developmental psychology: the Vygotskian belief that children construct knowledge during their indoctrination with the community at large; and the Piagetian belief that children construct knowledge on their own as they interact with the environment (Heflich, 1996). The Vygotskian school of thought places more emphasis on the teacher and the social milieu of the classroom, since knowledge is defined as a cultural entity; whereas the Piagetians place stronger emphasis on the biological aspects of the individual learner (Richardson, 1994). These two schools share the belief that learning is predicated on the individuals' active involvement with their environment. Roots of constructivist thinking may also be traced back to experimental psychology (Bartlett, 1932 and Iran-Nejad, 1980 in Heflich, 1996). Despite the differences in conceptions, educational practices that spring from these schools of thought are remarkably similar. Both theories emphasize that students should be actively engaged in their learning, in activities which are situated in a context that is authentic and rooted in the students' own real world experience.

Constructivism is concerned with the learning relationship as it is enacted in the classroom. It describes learning as it should be as opposed to prescribing a method of instructional practice (Richardson, 1994). In consideration of the learning relationship one must consider the issue of

power. In a traditional, didactic classroom, power resides with the teacher, and knowledge is transmitted to the students by the teacher. As the classrooms change from didactic, teacher-centered to constructivist, learner-centered learning environments, power shifts correspondingly from the teacher to the learner. Teachers will begin to shed authoritative roles, and assume more collaborative and facilitative roles. Using this framework, this study examined the extent to which use of online communications supports a constructivist learning classroom environment.

The second theory is the teacher decision making theory which relates to teachers' thought processes. This theory describes teacher decision making as a three stage process: preactive, interactive, and postactive; that is, occurring before, during, and after teaching (Jackson, 1968). The decision making theory views instruction as an ongoing process that is under the active direction of the teacher. Shavelson and Stern (1981) provide this description:

> Instruction is viewed as multifaceted with goals, content, activities, and teaching methods orchestrated by teachers to provide a flow of activity toward hoped-for outcomes. p. 3

In this conceptualization, teachers' plans are a central focus. Teachers integrate knowledge and information about students, the subject matter, the classroom and the school environment to formulate and evaluate plans; they also monitor the activity as it progresses. If activities are proceeding as planned, teachers concentrate on maintaining the flow; if not, teachers activate a routine for handling unplanned events. The final loop in this conceptualization occurs when teachers evaluate the outcomes of instruction in order to improve planning and future practice. Later researchers (e.g. Westerman, 1991; Borko and Livingston, 1989) have also identified the three stages of teacher decision making: planning, teaching, and reflection. Each of these stages has implications for integration of use of the Internet.

The teacher decision making framework was used to examine the integration of the use of on-line communications with the teachers' on-going decision-making processes. Winkler and Shavelson (1982) identified several possible areas of integration with respect to microcomputer-based learning. These areas include: the instructional goals that teachers have for their students (e.g. achievement, motivation, social skills); features of the curriculum with which they are coordinated (e.g. subject-matter concepts, other course materials and activities); learning activities surrounding their use (e.g. types of courseware assigned, student groupings); pedagogical consequences of their use (e.g., extensiveness of use); and the degree to which they are monitored and may change in response to feedback. This framework helped to investigate how teachers make decisions regarding integration of the Internet in classroom instruction.

Methods

Two technology-rich inner city middle schools in the Greater Los Angeles area were selected as pools from which to select teacher participants. Both schools were well equipped with technology. All classrooms in these schools had an average of four computers with Internet access and each teacher in the schools had portable notebook computers. Four teachers who were identified as users of the Internet in their classroom instruction by school administrators, peers, and self reports were the 'cases' of the study. Each teacher was contacted and their voluntary participation in the study requested.

Data collection was designed to gather information on teachers' preplanning processes, the actual instructional processes, and teachers' and students' reflections about instruction. Hence there was an initial interview with each teacher that focused on what they intended to do in a given unit (the intended curriculum). Next, there were a series of classroom observations which provided the opportunity to gather data on the operational curriculum. During this phase, teacher and student behaviors, their roles and relationships, as well as the role technology played were observed. After the observations there was a focus group interview with a selected group of students and post interview with the teachers. These interviews were designed to discover how students and teachers felt about the unit and the role of technology.

Findings

The four teacher participants in the study were Linda Smith, who taught sixth grade math and science; Jenny Edwards who taught seventh and eighth grade math and science in the same school; Andrew Baker and Steve Kennedy both of whom were at the other school and taught seventh grade science and history respectively. Each teacher was working on a different project with their students. Linda's class was working on a unit on planets and the students were creating space cubes and web pages with information about the planets; Jenny's students were involved in a collaborative project where they collected water samples and e-mailed to Washington DC for analysis. They were also working on an environmental science unit and were researching different environmental hazards. Andrew Baker's class was working on a health unit and the students were creating public service announcements to raise teen awareness of health hazards. Steve Kennedy's class was working on a project in which they were reenacting the lifestyles of ancient Japanese tribes and war lords. Answers to the following questions were gathered through observation and interviewing of students and teachers.

In what ways do teachers use on-line communications in the classroom?

> *We use it a lot like as a reference source to get information that we otherwise wouldn't be able to get..kind of like a super encyclopedia (Linda Smith)*

Apart from research purposes, Linda's students used the Internet as a platform for exhibition to publish their planet web pages. Linda Smith also used the Internet for graphics. "It is like a virtual museum ...the kids are so impressed with cool pictures." Jenny Edwards explained how she used the Internet in two distinct ways:

> *One way is for students to search for information pertinent to their group inquiry project. I downloaded a list of web sites from Target Science. The other way is through this project Globe. Right now the only thing we're sending in is cloud type and cloud cover information...we're hoping to set up our weather station. They compare what we send in with satellite images...That's a very exciting project...the kids can e-mail kids in other countries, communicate to the scientists...and this is going to be going on all the time..the kids collect the cloud data everyday and send it over the Internet into Globe.*

Andrew Baker commented:

> *Mostly I use the Internet for the students to do research for their projects. At the moment I'm teaching a health class so they will go out and do research on various health topics, get the most current information from things like the Center for Disease Control and statistics about teenage pregnancies and AIDS and other topics that we talk about in class...so we use it mostly as a research tool.*

Andrew's students were also involved with the Globe project and used the Internet in much the same way as explained by Jenny Edwards. Steve Kennedy's students used the Internet to get graphics for their projects. Steve also used the Internet to present information to students:

> *...I created my own web page to have a list of sites which they can then open as a file through Netscape and they then have a specific list which functions like a web page so they don't have total freedom to wander any where on the Net. I've created parameters...another way is that I will be putting together a presentation on Hyperstudio on the topic of tsunamis. I will be downloading some information from various web sites on tsunamis and including them in my Hyperstudio stack including text, pictures, graphics and quicktime movies.*

This type of use raises the question of a teacher's decision to preselect web addresses for students as a way to narrow the scope in order to facilitate more indepth inquiry, or as a means to control the information that students find so that students encounter only what the teacher wants them

to know. The difference in these two positions was that one facilitated student inquiry and exploration while the other limited them. This difference was highlighted by contrasting the decision-making and actions of Linda Smith and Steve Kennedy. Steve Kennedy was so intent on having his students access only the information that he 'packaged' for them that he created his own web page which did not give students access to any information other than what he put there. He felt that students should not have "total freedom to wander any where on the Net," so he "created parameters for them to operate in." He commented:

> *The primary use in this Japanese unit will be for me to prepare a presentation for the students...I will have already packaged the information into a premade lesson by me, they will be accessing the information as I've organized it,...I have found that given the opportunity to explore on the Internet, most kids struggle, and I get very little accomplished in the time so it behooves a teacher to plan ahead and pull out and isolate the information that they wish the students to access.*

Linda Smith also planned ahead and preselected sites for students but she did not isolate the information. Her list of sites served as a guide, and her students had the freedom to explore other linked sites to the one she gave them. She said:

> *I found that for me the most success I've had is when I do a little bit of research ahead of time and I make a list of URLs that will be useful to the kids because even myself have a hard time weeding through when you get two thousand three hundred and fourteen hits it takes a long time to weed through 'em so its really helpful for the kids when you list them on the board and they open them up and then from there they have reign to go wherever they want as long as its linked to one of those pages ... that cuts down on a lot of the wasted roaming around on the Internet because its so easy to do that even as an adult there's so much there...*

The key issue with Linda was not to control the students so that they had access only to what she provided, instead, she wanted to narrow the scope of the research and help students focus their study. Going back to the theoretical framework of the study: Does the use of on-line communications provide the potential to create constructivist learning environments where students have the freedom to seek and negotiate meaning? The fact that it was done by one teacher (Linda) suggests that it can be done. Does that mean that it happens in all classrooms? Absolutely not because even though Steve Kennedy was very knowledgeable about the use of the tool, he still created an environment where students could not explore beyond what he gave them. He was using the tool but his teaching philosophy was still very traditional. In his opinion, the students'cannot handle' too much information; therefore, *he* (the teacher) must 'isolate' the pieces that *he* deems important for them.

Table 1: Summary of Patterns of Use

	Linda	Jenny	Steve	Andrew
E-mail for teacher use	x		x	x
Students accessing information for projects	x	x	x	x
Showcase student work	x			
Students accessing graphics	x	x	x	x
Reference source for students	x	x	x	x
Research tool for students	x	x	x	x
Teachers downloading lesson plans		x		
Teachers accessing information, graphics, videos, to package for student use			x	
Globe collaborative science project		x		x

2) In what subject fields do teachers use on-line communications?

One of the four teachers was a science teacher, two taught mathematics and science, and one was a history teacher. Does this mean that these are the only subjects in which on-line communications are used? No. There were teachers who taught the same subjects in these schools who were not using the Internet; just as there were teachers in other subject fields who used on-line communications but did not participate in the study for a number of reasons. The closest indication on whether the Internet has more applications to one subject field versus another was from the patterns of use of the two teachers who taught both mathematics and science. Both teachers found ways to integrate use of on-line communications in science, but each confessed that they did not use it in their math curriculum. Linda Smith said, "It just does not apply to my geometry unit...science is so explorative, but math...unless I ask them to search the history of Pythagoras or something..." Rightly or wrongly, she did not have a math curriculum that integrated the use of the Internet.

Another interesting finding was that the teachers who taught two subject (math and science) did not integrate the content of both fields. There was a set time for science and a set time for math. It is important to consider that these teachers were trying the core approach for the first time and both had previously only taught science. The only teacher who attempted to integrate his curriculum with another content area was Steve Kennedy, the history teacher. His projects were integrated with the language arts curriculum, and he worked with the teacher to coordinate instruction.

The fact that only one of the four teachers was making any effort to develop interdisciplinary units was notable because the purpose of selecting the middle grades for this study was to investigate the extent to which the use of on-line communications supported interdisciplinary instruction. Linda Smith's team partner (who taught her students language arts and history/social science) was in a classroom next door to hers and even though they were friends, they did not plan instruction together. It was apparent that most teachers did not implement interdisciplinary curricula, nor did they collaborate with their team partners to plan instruction.

3) What purpose(s) does the new technology serve in the curriculum?

The Internet gave the teachers easy access to a wealth of resources that heretofore was difficult to obtain. They used the Internet to bring their instruction alive and expose students to different parts of the world. Steve Kennedy commented:

> *It allows me to be more creative; I like to see students have a chance to generate their own presentations using technology in different forms some of that through the Internet...I find that my access to information is greater, I don't have to work as hard to get this information any more...if you only have one book on that source, you really can't have a number of groups look at it but with the Internet a number of groups can access the same site at the same time...*

Linda Smith commented on how her unit might be different if she did not have access to the Internet:

> *The unit would take longer because I'd have to do more footwork to really pull in a lot more; one set of encyclopedias probably wouldn't be enough. How many great picture books can you get? I think it frees the teacher in terms of I'm not the one responsible anymore for bringing material in...the shoe is on the other foot; it's now the students responsible for looking, finding, and doing something with the information that they get...so it takes a lot of the responsibility off of the teacher because now, the kids are looking for the information and they're very reluctant to do that...*

Linda's comments indicated the shift of responsibility from the teacher to the student. As Hannafin and Savenye (1993) stated, change occurs only to the extent that a shift in responsibility to the learner occurs. In other words, the teacher' role changes as much as she allows the role of students to change. The more responsibility given to students, the greater the shift in the teacher's role. It appeared that Linda Smith knew and understood how to effect such change in her classroom. Jenny Edwards did not give the Internet an overall endorsement because she found that sometimes it was easier for her to find information in books than through the Internet. She stated:

...Personally I prefer to go tell the librarian, here's a topic I'm researching, can you get me some good books and she comes back in a half an hour with a stack of books...and I know they're all going to be relevant to what I need..[instead of] I'll be on the Internet for three hours and can't find one web site that has anything to do with what I'm looking for...

Steve Kennedy also commented that sometimes the Internet was not the best source of information. He provided his students with books, CD-ROM programs, and other software that may contain relevant information. Linda Smith made a point to remind her students that the Internet was only "another source" of information. "It does not replace books," she said to them. The Internet served to provide information that was not easily obtainable from books. For instance when Linda did a unit on temperature, she had her students use the Internet to find information about temperatures in different states for purposes of comparison. She explained:

...I had the kids do a follow-up...where they are given specific projects like for [the] weather [unit], finding temperature readings from different states...that would be something that they would need to use the Internet for...I don't like to have them to use the Internet just for the sake of using it...

4) What problems do teachers and students encounter when using on-line communications?

Several problems and challenges faced the teachers and students as they tried to integrate the use of on-line communications in their curriculum. The recurring problems mentioned by the teachers included time, reliability of the technology, problems related to integration with the on-going curriculum, and classroom management.

Time

Time was a major concern for both teachers and students. Teachers felt that there was not enough time to maximize the potential of the Internet. Andrew Baker commented, " If I would have had more time, I would find some sites...I would give them some general sites to go find...I would want to point them down the right path so at least they're close. All the other teachers agreed that they did not have adequate time to preselect sites to guide students as much as they would want. Linda, who seemed to do this more than the others had to invest a lot of her own time and stayed up late at night surfing the web to prepare her lessons.

Another issue in terms of management decisions was time on the computer. All the teachers put the students on time schedules. Linda Smith usually had her students on the computers for fifteen to twenty minutes at a time. She believed that imposing this deadline kept her students on task:

I hear them say to one another 'hurry because she's going to pick somebody else'...and if I see that they're wasting time, I'll rotate them out and they'll work at the desk until they're ready...

Time was also an issue from the students' perspective. One student commented; "Sometimes it's hard to get on the Internet especially if you don't have that much time because it takes too long and you'll just be sitting there..."Coupled with the time factor, the number of computers in a classroom had an effect on how teachers planned their lessons and their decision-making around use of technology. Some decisions were based on *equitable access* to the technology for students. Linda Smith explained:,

I end up bringing in a lot more materials so that the kids who are on the computers are not the only who are working ..[the teacher next door] has four computers so I ask her, can I send two kids over? or we'll plan a day where we go to the [computer lab]. I try to keep the objectives the same no matter what tools we use. You just have to be creative and get other ways for them to access information ...and the librarian's really good here if you talk to her in advance and ask her is it okay if I send two or three kids at a time to do some research, she would cooperate...

One common aspect to all the projects that incorporated use of the Internet was their multifacetedness. Each teacher designed projects that involved several components. In this way, all students did not need to be doing the same things at the same time. For example. In Linda Smith's

space unit while some students were on the computer doing research, others were working on the space cube; in Jenny Edwards case, student groups were designing experiments while other groups were researching on the Internet; Andrew Baker's class was divided between those researching on the Internet and those designing paper-based posters or pamphlets.

Another problem encountered with use was that of censorship. The two schools had similar ways of restricting students' access to inappropriate sites. There was a schoolwide policy that required students and parents to sign acceptable use agreements, and be issued a card in order to use the Internet. Linda Smith used the following slogan to remind her students of their responsibility to use the Internet according to the terms of the policy: Just because you can go there does not mean you should.

Reliability of the Technology

Often times during a lesson, the computer froze or quit unexpectedly during use; and sometimes the sites were unavailable. One student expressed her frustration, "Sometimes it takes like five minutes and then you get 'error 504 or something: File not found." Another student concurred: "one time I was searching for something, it took like seven minutes and it was not even found." Linda Smith stressed the importance of always having a backup plan in case the technology failed:

> *...you always need a backup plan...once when we were doing [a project], our routers were experiencing technical difficulty...a good part of the time we could not get on line...there's nothing worse than trying to get on line and not being able to...sometimes you have to do something completely different from what you planned like close everything down and see if you can go get space in the library to get some research done...*

Andrew Baker's students were unable to use the Internet on a project because the network in his room was down for two weeks. He ended up having to supplement with information from other sources such as books, magazines, and videos.

Integration with the On-going Curriculum.

One of the challenges teachers faced was determining when and how to integrate the use of the Internet with projects. Andrew Baker felt that if he had more time, he would incorporate use of the Internet with more class projects. Steve Kennedy also felt that lack of time affected frequency of use. He explained his difficulty:

> *I'm still struggling with that one [when to integrate use]. I imagine if I had more time, I would find many many more ways to incorporate it. I try to find at least one way in each unit that I can incorporate some resource from the Internet either through student-centered activity or presentation...as an opening, interest activity, reinforcement activity, or concluding activity.*

By interest activity, Steve was referring to motivational activities that sparked the students' interest in an upcoming unit:

> *if we're studying renaissance artists, to go out and visit sites sites that show various works of renaissance artists...most textbooks only have one or two images of an artist, and they're usually not presented very well...let's say I want to introduce them to Michelangelo, I might take them to the Vatican web site for the Sistine Chapel which has 385 images of just the ceiling...*

As a concluding activity he might have students "present web sites that they found related to a topic and discuss how these sites directly relate to the area that they were studying."

One of the concerns expressed by Jenny Edwards with regard to integration was that a teacher was left to figure out how to integrate use of the Internet to the ongoing curriculum. She stated that when she downloaded lesson plans from the Internet, the plans did not include strategies for integration to the curriculum.

Classroom Management

One of the challenges the teachers faced was how to manage a class of over thirty students with an average of four computers. The teachers felt that the key to this problem was to structure projects that had multiple dimensions so that there were several things to be that did not require direct interaction with the computer. As was described, each of the projects that integrated the use of the Internet had multiple parts: When Linda's students could not use the computer, they worked on their cubes and their illustrations; Jenny's students worked on designing and writing up their experiments; Andrew' students worked on posters, and pamphlets. In each case, because there were several parts to the project, each member of the group had a task so that students did not have to sit idle while waiting to use the computer. The teachers preferred this approach to integration rather than going to the school computer lab where every student could have a computer. Linda stated that she used the computer lab only when she was teaching a specific skill and she wanted to give the students practice time. For example, she took her class to the lab to practice web navigation skills. Linda felt that it was easier to manage the students in the classroom than in the lab especially in terms of monitoring on-task behavior. She also felt that the lab environment did not facilitate group work and collaboration:

> *A lot of kids do not feel comfortable in the lab because their reading skills are not where it should be so it's easier for them to work with another person because they can point things out to each other: one can read and the other can take notes, and they can switch. I know a lot of teachers say "I wish I had a computer for each student" but I don't know that that's the most efficient situation.*

5) How does the use of the new technology affect the learning environment?

Steve Kennedy believed that the use of the Internet affected his classroom learning environment because "students realize that there's a wealth of information out there and the ones who are quicker to realize it want to be able to use it and find information."

Linda Smith described her classroom environment as "mellow..kids feel enough freedom to take risks...I don't want the kids marching into the room, sitting down and waiting for me to tell them what to do..." She stated that she constantly struggled to wean her students from overdependence on the teacher. She worked hard to make students take the initiative and explore to find answers to their own questions. She felt that on-line communications affected her learning environment to the extent that her students were becoming dependent on the computer as an alternative source of information. She felt however that excessive student dependence on technology made it all the more difficult to engage students' interest when the technology failed. "...I don't want the kids to think that if we can't get on line, everything else is ruined..." Therefore she tried to maintain a balance in her room.

One of the obvious changes in the learning environment that occurred with use of technology was the change in dynamics of the classroom when students were working on the computers. This was more observable in Jenny Edwards' and Andrew Baker's classrooms because they had more distinguishable direct instruction and cooperative group activities. These two teachers typically had a 15-20 minute direct instruction period at the beginning of class when the focus was on the teacher. As soon as that period was over and it was time to work in groups and use the Internet, the teacher was no longer the source of information. The students who had been somewhat passive became more engaged in the task.

Students usually went to the computers in pairs. Breaking the groups into pairs kept everyone on task; and the students kept one another accountable. Partners at the computer made decisions about information and graphics to use or discard, and other content issues. Typically, they called the teacher when there were technical problems such as the computer freezing or they could not locate a site. The computer was then the source of information and this switch of focus from the teacher affected the roles and relations as will be discussed in the next section.

6. How does use of the new technology affect roles and relationships in the learning environment?

> *students are rarely spending all period in their seats focused on just the same task in front of them ..students engage in a number of activities which breaks them up and they get into different modes...there's a certain amount of academic freedom...I caution students not to violate that or they*

lõse certain privileges...my class is not sit at the desk, do your book work, don't talk. There's time to talk - talk about work and there's time when to listen to who is speaking in a traditional directed lesson type manner..(Steve Kennedy)

Steve Kennedy Steve Kennedy described his classroom environment as "organized chaos."He stated that use of the Internet affected his role because it afforded him the opportunity for greater access to information. He was able to find web sites relevant to class projects and thus be a better resource for his "...if you only have one book on a source, you really can't have a number of groups look at it but with the Internet a number of groups can access the same site at the same time..."

Contrary to Steve's perceptions of himself, the technology did not change his role as the 'dispenser' of knowledge. The simulation project maintained the status quo of the teacher as the controller and transmitter of knowledge. Despite his extensive knowledge of technology, Steve used the technology as another medium to transmit knowledge to students. Cuban (1986) found that many researchers attributed the failure of technology innovations to teachers' inability to adapt their teaching styles to maximize the potential of these innovations.

Linda Smith commented on how the use of the Internet changed the roles and responsibilities in her classroom:

I think it frees the teacher in terms of I'm not the one responsible any more for bringing material in; the shoe is on the other foot; it's now the students responsible for looking, finding, and doing something with the information that they get so it takes a lot of the responsibility off the teacher because now, the kids are looking for the information.. and they're very reluctant to do that...

Despite their reluctance, Linda's insistence on her students' taking responsibility for their learning empowered the students, and they had begun to internalize the fact that the Internet was a place to go to when one needed information. Linda's class projects were very student-centered, and she promoted learning by discovery. During classroom activities, her students were very much engaged in higher order critical thinking discussions and interactions with one another. They related to Linda not as 'the know-all teacher' but as a valued resource. She constantly challenged students to think about and evaluate the information they found on the Internet and elsewhere. During interactions with students she would often ask, "Why did you include this?, Let's think about this for a minute, what do you think the writer wants you to know, and what do you want your reader to understand?" Linda commented that the use of the Internet sometimes put the student in the role of the tutor:

The kids have a different perspective, they're not afraid of the technology whereas some adults are afraid..I really think that it allows the kids take on a little bit of the tutor role...they'll teach the other kids, and I hear them asking 'how did you get there?, or the neat thing is you'll hear them ask, 'can I write that URL?' and they do, the write down the URLs and they share it with each other. So I think it empowers them a lot, they feel that they're good at something that other people may not be but only because those other people haven't been exposed to it.

Linda also stated that the Internet helped her to improve her own knowledge. She learned along with the students. She described the Internet as the 'great equalizer.'

Sometimes the kids tell me certain things, and sometimes I'll say, 'no way!' and they'll say, 'yeah come here, look! And I say 'wow!' You know as teachers it's hard for the kids to see us as learners too, they think we know everything and when they find a great site and they bring me over to look at it, I think it excites them to see that maybe I didn't know that or I wasn't aware of that so I think that the Internet is like the great equalizer...there's something there that everybody can learn from, nobody knows everything that's on the Internet, nobody...

The Internet made Linda realize her responsibility to learn as much as she could in order to be a

resource for her students:

> *I can no longer be satisfied with chapter nine in the science book when it talks about space..the scientists are learning new things every day...in a way it puts a little bit more responsibility on a teacher but I think it opens up the possibilities of how much you can learn as you teach.*

In Linda's case we see a teacher who has submitted to the changes in teacher role that the use of on-line communications can foster; and thus she developed a powerful learning environment. Linda had a very open and friendly relationship with her students. Her students described her in this way: "She's like a good friend..she teaches us a lot.. she's nice to us, she likes to laugh a lot but she teaches us a lot too.." Neither Linda nor her students felt that the use of on-line communications affected the student-teacher relationship. Linda felt that she always tried to maintain a good relationship with her students and she tried to make the curriculum relevant to their lives even before she began using the Internet in her classroom.

7. What are the perceptions of teachers and students regarding impact and value of this technology?

A major value of this technology is the effect it had on students' motivation to do work. The teachers all stated that the students enjoyed using the Internet, and did not have to be persuaded to do work once it involved going on the Internet. They described it as a 'hook' which attracted students to the classroom. Andrew Baker elaborated:

> *If they know they're going to be using the Internet they'll definitely be here in school, they enjoy it ...because it's like a video game, they're visual learners...*

This teacher continued to say that the real value of this tool was that students learned without knowing that they were learning, and students were picking up useful computer skills that could help them in future careers.

Linda Smith stated that she valued the Internet because of the access it provided to places that would have been inaccessible. One of the slogans she used with her students was, 'just because you can't go there doesn't mean you can't go there.' She illustrated with the example that just because her students could not take a field trip to the Museum of Science did not mean that they could not get there. Therefore the Internet served to provide access to students to places they would not have had physical access to. One of Linda's comments was:

> *the potential for reaching out to the world is amazing... reaching out to other students, businesses, people in the community...there are so many places you can go...it opens up a whole new world to the kids...they'll see places via the Internet that they probably would never not only not have seen but not even known were there...it's fascinating.*

Another value that Linda stated was the access to current information which the Internet provided:

> *The potential for this tool versus a set of encyclopedias is that it's constantly being updated...and I don't care how much money a school has, they can never keep current encyclopedias...and we need to realize especially in the field of science that sometimes information changes daily and that's one of the things that on-line access has really been able to capitalize on is that these web pages are changed daily and you are being constantly, constantly on top of things. You never have to worry about outdated material.*

Steve Kennedy stated that he valued the Internet for its usefulness for "researching and accessing information that would enhance an educational project." One of Andrew Baker's students explained that he valued the Internet, "...because it explores and it makes me think better...because the Internet has a whole lot of different things about STDs, I got to pick the one I'm looking for..." Another student liked using the Internet because it provided access to graphics that enhanced projects. This relieved the burden of artistic drawing on students who were not good artists.

it would have been harder [if we did not have the Internet] 'cause we would have had to draw pictures and stuff and some people in this group can't draw...going to the library and looking through books [for pictures] would have been harder...but like on the Internet, when you type up <acne> ...pictures and stuff came with it, and you can just copy the pictures on a disk or print it (Cathy Bose, student).

8) What preparation is needed by teachers and students to use the new technology?

All the teachers made statements about the amount of time required for both teachers and students to learn to use this technology. Andrew Baker stated that lack of search skills affected his students' use of the Internet:

they needed help ...they couldn't find things by themselves, they had to pull me over and I had to guide them through it...they haven't had enough training yet to be comfortable enough to go out there and search...a couple groups told me they couldn't find any thing on their key words...or they would get a million hits and they wouldn't know how to sort through all that information ...

He went on to explain that this was the first year his students had access to the Internet in the classroom, and so the students were still very much in their developmental stages of use. They needed to be taught basic search strategies and navigation skills.

Other important skills that students needed in order to maximize the use of the Internet were reading and comprehension skills. Students who could not read copied information from the screen that did not make sense, and included such information in their reports without reading or assessing the information for relevance. In some cases, the students copied disjointed or incomplete sentences.

Teachers also needed preparation not only about the basics of using on-line communications but more importantly on how to integrate its use with the curriculum content that they taught. Jenny Edwards articulated the kinds of workshops she would appreciate:

Most of the technology training I have been to has either been too complicated or too simple...An ideal program would be...small group...with somebody who is a teacher, who knows and teaches the same subject you do and can help you sort of work things out and has a lot of ideas on how to do it or help you think through your lessons and units that you've been teaching for a while without using technology ...show you how to utilize technology in them.

Linda Smith and Steve Kennedy used technology in their classrooms more than the other two teachers in the study. However there was an striking contrast between the two teachers. Linda's classroom was definitely more constructivist than Steve's. Perhaps more important than a teacher's use of technology is the teacher's philosophy of teaching. Consciously or subconsciously, Steve's philosophy had affected his classroom practice. Though he had more technological skills than any of the other teachers and had great personal knowledge of computers and computer-based instructional media, he did not empower his students nor give them the freedom to seek and explore knowledge.

As portrayed in the literature, there are some teachers who are resistant to the changing teacher roles that could result with use of on-line communications. Steve subconsciously expressed this resistance when he described an alternative approach to having students have complete access to the web:

the other way is for the teacher to prepare ahead of time the information in a way presented to the students so that they don't have total access to the net, they only use the information the teacher prepped ahead of time.

In their description of the constructivist learning process, Duffy and Cunningham (1996) suggest that learning occurs when the learner confronts a problem which he/she must resolve. Steve did not give his students the chance to resolve encountered discrepancies; he was too quick to give them *his* answer. One of his students complained; "When you ask him to help you with something,

he just takes it over, he sits down and takes the computer and starts doing it himself." Steve is evidence that knowledge of technology does not translate to the ability to utilize that technology to create student-centered, constructivist classrooms.

On the other hand, Linda Smith was the only teacher whose students were truly independent and critical thinkers. If there is a continuum of teaching styles that spans from didactic through constructivist to self-directed student learning, Linda Smith was further along the road to constructivism than any of the other teachers. Her classroom exemplified a community of learners. Students were engaged in higher-order cognitive tasks, there was an atmosphere of collaboration, the teacher was not the only source of knowledge, the students and the teacher were comfortable with the use of technology to support and facilitate students' inquiry.

Conclusions: What We Learned

The teachers' use of technology in two technology-rich middle schools revealed a number of substantive teaching problems related to philosophic and sociologic issues, management issues, curriculum and instructional issues. Each of these will be discussed along with their implications for teacher preparation and professional development.

Philosophic and Sociologic Issues

These issues act as an umbrella affecting and screening out all other areas of decision making. Clearly, effective use of on-line resources necessitates both tolerance and trust o f student exploration and experimentation. Underlying tolerance and trust are philosophic beliefs about what students should learn, how students should learn, and long-standing sociologic traditions about teacher authority. Industrial age teaching traditions fail to take advantage of current information age technology. Effective use of the new technology necessitates cooperative student projects, discussion and debate about substantive data, and information skills that may need to be taught as needed. Technology transforms learning; in short, this means a changing role for teachers and students, changes in teaching style, and changes in the social milieu of the classroom.

These changing roles paint a different picture of the classroom community. The "new" work of both teachers and students affects the relationship between them. Students now need to ask the probing questions and teachers need to guide them to do so. Students need to communicate their findings instead of teachers telling the students what is significant. To empower students to explore and experiment, teachers' goals need to be flexible and they need to spend more time arousing curiosity and stimulating discussion and less time presenting information.

Implications for Preparation and Development

Teaching needs to be examined within the context of students' learning needs. How do we help students to become assertive and expressive as they use the new technology? With the focus on guiding STUDENTS (Big S) to be assertive and selective in using resources, teachers must define their own relationship (small t) in the process by identifying the behaviors they need to practice to accomplish the goal. The philosophic and sociologic issues require changes not only in teaching style, but in the way the teacher perceives him/herself.

Both in pre-service education and professional development, the teacher is learner. The learner must be the focus of constructivist learning opportunities. No longer can we "*train*" teachers. By implementing in staff development and methods classes, active involvement of learners, we can model appropriate attitudes and behaviors. Teachers need to experience the very same strategies and techniques that are appropriate for their students. Whether using technology or studying culture, the learners (teachers) must explore, create, define and express. teaching is not telling. We may not be able to wipe-out teachers' memories of their own early school years, but through practice and application, we can stimulate new habits and behaviors.

Management Issues

Management decisions are related to the use of computers in a laboratory or how many computers and where to place them in the classroom. In-class use requires decisions about how many

students work together on a computer, who uses the computer, what are the other members of the group going to do, time duration, and technical support when problems emerge.

In this study teachers had at least four computers in their classrooms. most studies suggest at least two computers plus telephone lines and power sockets are needed per classroom. All four teachers grouped students for computer access. Their planning decisions needed to include:

- Selection of appropriate software
- Teaching the software use to students
- Grouping decisions, spatial needs, time decisions
- Gathering a variety of materials and resources to involve all members of a group
- Experimenting with the software to acquaint themselves with the possibilities for inquiry
- Anticipating alternative strategies if on-line use is blocked and/or technical assistance needed

Implications For Preparation and Development

All of the management issues relate to classroom management. Appropriate management requires that teachers "...plan curriculum, organize procedures and resources, arrange the environment to maximize efficiency, monitor student progress, anticipate potential problems" (Lemlech, 1988, p.3). In pre-service education, the student teaching experience should include opportunities for the novice to practice teaching lessons that use he Internet and require cooperative grouping, active involvement of all students, a myriad of materials, and consideration of what to do when the plans break down.

For staff development teachers can exchange lesson plans, explore the Internet for research ideas and websites, and practice the same cooperative activities their students will need to engage in to work as involved participants in group activities. Clearly the work of teachers will be to plan alternate activities in case things go wrong, and anticipate needed resources so that all members of the group are involved in productive inquiry.

Curriculum and Instructional Issues

The changed environment of the classroom necessitates linking of subject fields (integration), thematic teaching, cooperative learning, flexible use of time, alternative teaching strategies when the search engine is blocked, and responding to equity of use issues. Middle school teacher are challenged to seek ways to integrate their curriculum, change the organizational structure of the school through block scheduling, and group students in "houses" or teams. Technology can provide some interesting ways to accomplish these goals.

For example social studies, science, language arts, and math teachers may integrate their fields by first choosing an overarching theme, such as *systems and interactions*. The teachers could select the CD-ROM *Simisle: Mission in the Rainforest.* This simulation challenges students to maintain a balance between nature and economics. The students must respond to natural and man-made disasters and make decisions involving resource management. Teachers' collaborative planning would need to include a variety of theme related learning experiences in each subject field. These experiences would link the simulation with research on the Internet and extend group activities using a variety of resources. Some of the activities for group work may include ecology projects emphasizing the delicate balance of nature in the rain forest, and students might compare tropical and temperate zone forests in science. In social studies students might study citizenship responsibilities, the study of building regulations affecting developers, overpopulation, tourism, and employment problems and how each interacts and affects the economy. In math students may grapple with problems involving learning to construct spreadsheets, formulas, and graphs on the computer computing and depicting employment figures, average rainfall, temperature and a variety of data related to the rainforest. In English the students may write their reports as well as create haiku verses about the environment and read literature about the animals of the rainforest.

The collaborative selection of the simulation by the teachers helps to provide a structure for integrating the subject fields, inquiry problems to be investigated, in part, using the Internet, and creating the constructivist orientation for learning activities. The extension of learning activities to encompass more than the simulation and the simulation and the Internet serves to involve all

members of the cooperative group in meaningful activities that require group planning and a variety of skills. However, the real key to integrating the subject fields will be a learner focused vision of teaching, and a willingness of teachers to create a professional environment and engage in professional development.

Implications For Preparation and Development

Most pre-service programs emphasize the solitary nature of teaching. The candidate is assigned to master teacher who demonstrates skills and subject matter the novice is expected to reproduce. Rarely is the pre-service teacher encouraged to work with others to share ideas, to team, or peer coach. It is little wonder that most teachers find it difficult to collaborate or invite others into the classroom. Yet this is precisely what needs to happen beginning in pre-service education.

Sage-like behavior from the teacher doesn't work very well when students are confronted with the authentic potential of the Internet. For those individuals who chose teaching to satisfy personal needs for control and power, the demands of technology will be overwhelming because appropriate use challenges student passivity. Students' natural spontaneity and curiosity need to be cultivated by teachers who accept the roles of guide and coach. The challenge for pre-service education is to model the "guide" and "coach" roles and screen-out those individuals who want to *play teacher.*

Clearly the need for appropriate in-service education is as great and significant as pre-service education. School districts spend an inordinate amount of time and money preparing teachers to use new technology, new instructional materials, and fail-safe discipline systems designed to protect the authority of teachers. What a waste! Experienced teachers need to focus on the "new basics" of constructivist methods by engaging in their own authentic learning projects, collaborating with colleagues, practicing enquiry, and monitoring their own accomplishments.

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APPENDIX A

Summary of Findings

	Teacher's Role	Student Behavior	Subject Matter	Classroom Environment	Teacher's Decision-making	Grouping	Assessment	
Linda Smith	constructivist, model, guide, facilitator	"Choosers" Independent thinking, decision-makers, empowered, interactive, collaborative, used technology as a tool,	conceptual focus on open curriculum, flexible; focused on subject field, no integration across disciplines	Open, learning community, very learner-centered.	Reality-based, ambiguity, unplanned events embraced; Constant reflection and adjustment based on new information,	groups as interdependent social systems, cooperative work, interest-based and oriented.	on-going assessments that informed subsequent instruction, authentic, observations, projects, exhibitions	Linda Smith
Andrew Baker	sometimes a guide, sometimes authoritative	sometimes active learners, some decision-making.	reality-based, relevant to students' lives yet no integration across disciplines	each lesson started out as didactic and teacher centered then broke into student-centered group work.	influenced by pressure to finish on time thus authenticity of projects were compromised	some student choice, interest-based.	use of multiple assessments but assessments did not inform instruction	Andrew Baker
Jenny Edwards	sometimes a guide, sometimes authoritarian, insecure around technology	passive, dependent on teacher direction, insecure around technology	fixed curriculum, no integration across disciplines	each lesson started out as didactic and teacher centered then broke into student-centered group work.	influenced by adherence to curriculum rather than student needs.	some student choice, interest based.	use of multiple assessments but assessments did not inform instruction	Jenny Edwards
Steve Kennedy	didactic, transmitter of information, positivist,	passive, very dependent on teacher direction, very little student-student interaction.	focused on a subject field, some integration with language Arts, "fixed" curriculum, pre-defined.	teacher-centered, transmission model	Pre-digested knowledge, no ambiguity allowed, packaged knowledge	Individualized work; teacher formed groups, no student choice	Paper pencil tests, isolated group projects	Steve Kennedy

APPENDIX B

Summary of Patterns of Use

	Linda Smith	Jenny Edwards	Steve Kennedy	Andrew Baker
How did the teacher determine the content?	teacher-made lesson based on set curriculum guides for grade level and student interest	teacher downloaded lesson plan from the Internet based on set curriculum guides for grade level and student interest	teacher got lesson from a book based on set curriculum guide for grade level	teacher-made lesson based on set curriculum guides for grade level and student interest
How were groups assigned?	students chose topics and groups were made of students who chose same planets.	students chose their partners. Focus was on partner not task	teacher assigned groups	students chose topics and groups were formed based on interests in similar topics: Focus on task.
How did teacher prepare students for interaction with computer?	modeling and hand-outs *before* students went to the computer, use of big screen, showing not telling, structured guided practice using the computer lab	telling not showing; modeling was used *after* students experienced frustration	presentation, telling, students did not use the computer	telling not showing; modeling was used *after* students experienced frustration
What was the teacher's role during group work?	interactive, did not give answer, asked leading questions	interactive, sometimes gave answer	took over control and did it for students	interactive, challenged students to think, asked leading questions
How was the student-student interaction while at computer	collaborative, interdependent, equal status, questioning, making choices,	one student tended to dominate; students depended on teacher for answers	students depended on teacher to answer questions	collaborative, equal status,

Summary of Patterns of Use Continued

	Linda Smith	Jenny Edwards	Steve Kennedy	Andrew Baker
Was there integration across disciplines?	teacher did not integrate content, not even math and science that she taught.	teacher did not integrate math and science that she taught, but tried to allign science with the language arts teacher	teacher integrated language arts and history through collaborations with the language arts teacher	teacher did not integrate content
What was the nature of student-teacher interaction while at computer	collaborative, equal status, students sought teacher's opinion but made decisions	students depended on teacher to tell them what to do	teacher took over sometimes control against students' desires, teacher was Mr. fix-it	teacher forced students to make decisions by not telling them answers
How was the task structured?	teacher provided guiding framework but students had freedom to make decisions; task was authentic in that students created real a web pages.	teacher provided framework	task was a simulated game with very structured rules and roles.	teacher provided guiding framework but students made decisions. Task was authentic because students created products to raise teenagers' health awareness
Who made the decisions on what was to be learned?	teacher with consideration for student relevance and interest	teacher with consideration for student relevance and interest	teacher	teacher with consideration for student relevance nad interest
Who decided on structure of the product?	students; teacher gave input but students had the power to decide	students with teacher approval	teacher	students - teacher gave input but students had the power to decide
How did the integration of technlogy affect the learning environment?	the Internet was seamlessly integrated into the science curriculum but not in math. There was a smooth transitioning between technology and non-technology based activities	the Internet was integrated but the transitioning from technology-based to non-technology based activities was abrupt.	the Internet was almost "sacred." The teacher had to 'package' it before students could use it.	the Internet was integrated but the transitioning from technology-based to non-technology based activities was somewhat abrupt.